IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Vivian Alberts
App. No	:	10/568,229
Filed	:	February 14, 2006
For	:	GROUP I-III-VI QUATERNARY OR HIGHER ALLOY SEMICONDUCTOR FILMS
Examiner	:	Sikyin Ip
Art Unit	:	1793
Conf No.	:	6289

DECLARATION OF VIVIAN ALBERTS UNDER 37 C.F.R. § 1.132

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Vivian Alberts, do hereby declare and say as follows:

1. I am currently a professor and head of the physics department at the University of Johannesburg in South Africa. I have been a professor at the University of Johannesburg for over 16 years. My work has focused on photovoltaic cells, in particular the growth and characterization of polycrystalline ternary, quaternary and pentenary semiconductors such as $CuInSe_2$, $CuIn(Se,S)_2$, $Cu(In,Ga)Se_2$, and $Cu(In,Ga)(Se,S)_2$. Over the course of my career I have been an author or co-author on over a dozen papers concerning photovoltaic cells. In addition, I am an inventor on various patents in the field of photovoltaic cells. A list of some of my publications and patents is provided in the attached curriculum vitae. I earned my bachelors of science degree from the University of Port Elizabeth in 1985. I earned my masters of science and PhD from the University of Port Elizabeth in 1990 and 1993, respectively.

2. I am the inventor of the invention claimed in U.S. Patent Application 10/568,229, which was field on February 14, 2006, and which is referred to herein as "the '229 Application." The '229 Application discloses, among other things, group IB-IIA-VIA quaternary or higher alloy semiconductor films.

3. I have read and understand the claims in the '229 patent application. I understand that the claims concern various group IB-IIIA-VIA quaternary or higher alloys (Claim 1).

4. I have read and understand the rejections in the Office Action dated August 19, 2009. I understand that the above described claims, Claims 1-13 stand rejected under 35 U.S.C. § 103 as unpatentable in view of "Improved CIGS thin-film solar cells by surface sulfurization using In_2S_3 and sulfur vapor" by Ohashi et al. (hereinafter "Ohashi") Solar Energy Materials & Solar Cells 67 (2001) 261-265.

5. I have reviewed the references cited by the Examiner, including Ohashi. The cited references and Ohashi disclose the material properties of hetrogenous alloys in which a $Cu(In,Ga)(Se,S)_2$ layer is formed on the near-surface region of a $Cu(In,Ga)Se_2$ bulk film. Due to the substantial compositional gradients in both the group III and VI elements, these alloys cannot produce a glancing incidence x- ray diffraction pattern (GIXRD) for glancing angles at 0.5°, 1°, 2°, 5°, and 10° that reflects an absolute shift in the $2\theta_{(112)}$ angle of less than 0.06° within any measured range, for example, between 0.5° and 1.0°, or between 0.5° and 2.0° or between 0.5° and 10°.

6. Ohashi fails to disclose any information for glancing angles of 0.5°, 2°, and 5°. Measurements within any range between these angles would reflect a shift in the $2\theta_{(112)}$ angle of more than 0.06° because the alloys of Ohashi are heterogeneous and show the compositional gradient in the AES depth profiles shown in Figures 1(a) and 3(b).

7. This general principle is also supported by my findings reported in "A comparison of the material and device properties of homogeneous and compositional graded $Cu(In,Ga)(Se,S)_2$ chalcopyrite thin films", which was published by the Applicant in 2007 in Semiconductor Science and Technology, 22, 585. Figure 3(b) shows a significant shift between at least two ranges of the five angles measured (0.2°, 0.5°, 1.0°, 5.0°, and 10°) for a compositionally graded CIGSSe sample. In particular, it should be noted that the shift in the position of the $2\theta_{(112)}$ angle in the range between 0.5° and 1° is in the order of 0.3°, while the

relative shift is in the order of 0.5° in the measured range between 0.2° and 1°. The properties of the sample measured in the article are similar to those of the alloys produced and studied in Ohashi.

8. I would expect alloys produced by the two-stage method or co-evaporation processes of the prior art methods to exhibit shifts of greater than 0.06° for at least one of the ranges indicated in point 5 above when measuring the glancing incident angles of 0.5°, 1°, 2°, 5°, and 10°.The co-evaporation and two stage methods of the prior art produce compositionally graded alloys with graded band gap values (i.e, value varies with sample depth). In general, these alloys are only capable of shifting the band gap within limited ranges depending on the degree of compositional grading or phase separation.

9. I am not aware of any prior art that discloses a quaternary alloy of $Cu(In,Ga)Se_2$ or a pentenary alloy of $Cu(In,Ga)Se,S)_2$ with a glancing incidence x ray diffraction pattern (GIXRD) for glancing angles at 0.5°, 1°, 2°, 5°, and 10° that reflects an absolute shift in the $2\theta_{(112)}$ angle of less than 0.06° within any range which is measured over a representative depth of the alloy.

10. I am not aware of any prior art that discloses methods that could produce a quaternary alloy of $Cu(In,Ga)Se_2$ or a pentenary alloy of $Cu(In,Ga)Se,S)_2$ with a glancing incidence x ray diffraction pattern (GIXRD) for glancing angles at 0.5°, 1°, 2°, 5°, and 10° that reflects an absolute shift in the $2\theta_{(112)}$ angle of less than 0.06° within any range which is measured over a representative depth of the alloy.

11. I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true. I declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectfully submitted,

Dated: 12/2/2010

By: _____

Vivian Alberts

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